1867MNRAS..27..206H

magnitude and with a serpentine course. There was no well-marked time of maximum display, but there seemed to be alternate periods of repose and activity.

After *Gemini* passed the meridian the sky became overcast; and, though I watched closely for openings in the clouds, I saw nothing until 3ʰ 8ᵐ, when an immense fire-ball flashed through a misty break in *Leo*, and all again was darkness. Soon after this it partially cleared towards the east, and from time to time I was able to catch sight of a meteor moving in that direction. At about five o'clock there was heavy rain that continued for half-an-hour; and at 5ʰ 53ᵐ I remarked one meteor falling from the direction of *Gemini* through *Hydra*. The west and north were still clouded, and I saw no more until *Saturn* appeared enveloped in the breaking day, when I left off observing.

As there were some of those meteors that might be well distinguished from the rest, I was careful to mark their places on a map, hoping that they might, perhaps, be identified by other observers, and have their height determined

The most remarkable appeared as follows:—

| G.M.T.<br>1866,<br>Dec. 12–13.<br>h m | |
|---|---|
| 10 18 P.M. | Close by Procyon, in a line from δ Geminorum; as large as Sirius. |
| 10 53 | Through Præsepe, in a line parallel with Castor and Pollux. |
| 11 11 | From Procyon, in line produced from direction of β Aurigæ. |
| 11 51 | Precisely over *g*, and between ζ and γ Leonis. |
| 0 11 A.M. | From close below ϰ Ursæ, across υ. |
| 1 14 | Near Sirius, between μ and γ; larger than Sirius. |
| 1 35 | From ε, in a curve between η and γ Leonis. |
| 4 30 | From Draco, across the Camelopard to the true Pole, in a perpendicular to the Pole and ζ Ursæ Min. |
| 4 36 | In Corona, pointing from near δ Böotis to near δ Coronæ. |

Place of observation, Lat. 53° 37′ 43″, Long. 8° 53′ (approximate).

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## *On the Compatibility of the Retrograde Orbit of the November Meteors with the Nebular Theory.* By John Hippisley, F.R.S.

In the *Monthly Notices* for December 1866, Sir John Herschel, having arrived at the conclusion that the orbital motion of the November meteors is *retrograde*, leaves it to the advocates of the nebular hypothesis to reconcile that fact with their theory.

The nebular hypothesis supposes that space was once,

1867MNRAS..27..206H

generally, though not equably, nor homogeneously, filled with matter in a nebulous form. And that the Sun with his planets and satellites, and the fixed stars with their presumable attendants, represent the ultimate result (at least up to the epoch in which we live), of the several aggregations of large volumes of nebulous matter at and around different centres of predominant attraction.

It would seem a necessary consequence of such a supposed distribution, that outlying patches of the nebulous material would remain in the intervening spaces, having no decisive preponderance to any of the more important centres. These portions, though severally insufficient in amount for the formation of a luminous Sun and its planetary system, would nevertheless be subject to the same principles of aggregation, and would in course of time form systems minute, but analogous to those of more importance and splendour. A central body, perhaps not luminous, or soon cooling down to non-luminosity, with rings or planetoid companions.

Such systems might be very numerous, insomuch that the Sun, by reason of his proper motion through space, might frequently approach and annex them to his own system. In the case of direct collision an extraordinary accession of light and heat (such as the recent blaze in *Corona Borealis*, or the remarkable phenomenon seen by Mr. Carrington and another observer in the Sun's photosphere) would signalize the termination of the career of the miniature system at the surface of the Sun. In any other case an orbit, more or less excentric, would be the result, the elliptical proportions of which would be determined by the direction and amount of the relative proper motions of the system and of the Sun at the epoch of annexation. *But it would depend on the accident of the system's approaching from a point to the east or the west* of the Sun's path through space, *whether this orbit should be direct or retrograde*, and its inclination to the plane of the ecliptic would be determined by the place relatively to that plane which the system occupied before annexation.

An orbit originating out of such circumstances would probably be very excentric, as are those of the comets, and of the November meteors, to which, in accordance with the deductions of the Astronomer Royal, we may ascribe a considerable excentricity and inclination.

The velocity of minute planetoids round a small central body would be slow in comparison with the known planetary velocities. And the minute system itself would be invisible from the Earth, except in case of extremely close approach or contact.

Suppose, then, the November meteorites to be not a continuous ring around the Sun, but a ring of planetoids revolving at a slow speed about some small central body; that this system was not an original member of the solar system; that

1867MNRAS..27..208H

it has been annexed; that its approach to the Sun was from a point to the west of the Sun's path through space; that it now revolves round the Sun in a year nearly; that the distance of this orbit at its node is such that the outer part of this system, namely the ring, reaches to the Earth's orbit, and that the period of the revolution of the ring about the central body is either 33 years or some other period, differing from one year, or other sub-multiple of 33 years by the fraction suitable to the observed periodical recurrence of the concentrated portion of the ring; under these suppositions conditions would be present compatible with the nebular hypothesis, and consistent with the observed retrograde orbit of the meteors. Their real path through space will, it is true, be slightly different from that which a continuous ring around the Sun implies; but as their revolution around their principal may be very slow, their translation through space, as seen from the Earth, will depend chiefly on their orbital motion round the Sun.

An elliptical orbit of any dimensions, provided that the perihelion distance be not greater, and the aphelion distance not less than the semi-diameter of the Earth's orbit, will suffice, in combination with suitable inclination to the plane of the ecliptic, for the condition of a contact with the Earth at one only of the nodes. Probably, however, the area of the meteorite ellipse is not very different from that of the Earth's orbit.

The plane of the meteoric ring, since its revolution (which may be direct or retrograde), around its central body was established before its orbital revolution round the Sun commenced, may be inclined at any angle to the plane of that orbit consistently with the nebular hypothesis.

The retrograde and inclined orbits of comets may be accounted for on like principles, on the supposition that they also have become by similar annexation comparatively recent members of the Solar System.

*Stoneaston, January* 26, 1867.

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## *Considerations on Sun-Spots.* By M. Hoek.

(*Extract from a Letter to Mr. De La Rue.*)

"J'ai lu avec beaucoup d'intérêt la Note que vous venez d'insérer dans les *Monthly Notices* (vol. xxvii. No. 1), en commun avec MM. Stewart et Loewy. Elle contient des résultats qui m'ont rappelé d'avoir commencé, il y a plus d'une année, une recherche que depuis j'avais abandonnée, sans cependant me souvenir pourquoi. Dans cette recherche théorique mon point de départ a été l'hypothèse que le Soleil est